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VERIFIED TRANSLATION OF PRIORITY DOCUMENT

The undersigned, of the below address, hereby certifies that he/she well knows both the English and Japanese languages, and that the attached is an accurate translation into the English language of the Certified Copy, filed for this application under 35 U.S.C. Section 119 and/or 365, of:

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[Name of the Document] Specification

[Title of the Invention] Electronic Key System

[Claims]

[Claim 1] An electronic key system comprising:

5 a mobile unit that receives an interrogational signal and sends back a predetermined code signal in response to the interrogational signal;

a controller that transmits the interrogational signal to the mobile unit, receives the code signal which was set back in response to the interrogational signal, checks a relation between the code signal and a memorized signal, and controls a state of a door of a vehicle based on a check result of the relation; and

10 an light emitting means that is disposed on the vehicle to indicate the state of the door.

[Claim 2] The electronic key system according to claim 1, wherein the light emitting means changes an indication color between a first condition that the door is locked and a second condition that the door is unlocked.

[Claim 3] The electronic key system according to claim 1, further comprising:

a detection means for detecting an opening operation of the door that is operated by a user having the mobile unit,

20 wherein the controller sets the door of the vehicle in an unlock-standby state when the code signal transmitted from the mobile unit is authenticated when the user having the mobile unit approaches the vehicle, and unlocks the door when the opening operation of the door is detected by the detection means in the unlock-standby state, and

25 the light emitting means starts to indicate the unlock-standby state of the door in a certain indication mode when the door becomes in the unlock-standby state, and the light emitting means changes the indication mode when the door is unlocked.

[Claim 4] The electronic key system according to claim 3, wherein the light emitting

means is turned off when a certain time elapses or an engine of the vehicle is started.

[Claim 5] The electronic key system according to claim 1, wherein the light emitting means starts to indicate that the door is unlocked when the door is closed after a user having the mobile unit gets out of the vehicle, and

5 the light emitting means changes an indication mode to indicate that the door is locked in response to a lock of the door after the door is closed.

[Claim 6] The electronic key system according to claim 5, wherein the light emitting means is turned off when a certain time elapses.

10 [Detailed Description of the Invention]

[0001]

[Field of the invention]

The present invention relates to an electronic key system that controls a state of doors of a vehicle, such as a locked state and an unlocked state, based on an ID code transmitted from a mobile unit.

15 ID code transmitted from a mobile unit.

[0002]

[Prior Art]

Conventionally, it is known that a conventional electronic key system controls a state of doors of vehicles, such as a locked state and an unlocked state. The state of the doors is controlled based on a check result of an ID code of the mobile unit by communication between the mobile unit and the vehicle unit. The electronic key system also unlocks a steering lock and permits to start an engine when a user having the mobile unit is within a vehicle compartment.

20 The state of the doors is controlled based on a check result of an ID code of the mobile unit by communication between the mobile unit and the vehicle unit. The electronic key system also unlocks a steering lock and permits to start an engine when a user having the mobile unit is within a vehicle compartment.

[0003]

25 In such an electronic key system, predetermined detection areas are formed inside and outside the vehicle. The vehicle unit transmits an interrogational signal at a predetermined time interval toward the detection areas. The electronic

key system always monitors an approach of a user having the mobile unit, a ride on the vehicle, and getting out of the vehicle based on a response from the mobile unit in response to the interrogational signal.

[0004]

5 In detail, when the user having the mobile unit approaches the vehicle to ride on the vehicle and then the user enters into the detection area, the mobile unit transmits an ID code to a receiver of the vehicle in response to the interrogational signal. When the ID code of the mobile unit corresponds to the registered ID code, a control unit of the vehicle unit sets doors to an unlock-standby state. Then, when the
10 user having the mobile unit touches one of the doors in the unlock-standby state, the doors are unlocked in response to a detection of the touch via a touch sensor.

[0005]

On the other hand, when the user having the mobile unit gets out of the vehicle after the engine is stopped, the detection area is shifted from the inside of the
15 vehicle to the outside of the vehicle. When a door lock switch that is disposed near the door handle is operated when the detection area is formed outside the vehicle, the doors are locked.

[0006]

[Problem to be solved by the invention]

20 In such a vehicle electronic key system, the user having the mobile unit can lock and unlock the doors without holding the mobile unit in hands. This improves convenience of the user.

[0007]

25 However, the user cannot easily recognize the state of the door, such as the locked state, the unlocked state, and the unlock-standby state. For example, when the user having the mobile unit approaches the vehicle and then the user touches the door handle, the door is unlocked. However, the user cannot recognize

that the door is in the unlock-standby state until the user touches the door handle. In addition, the user cannot easily check the unlocked state of the doors when the user operates the door lock switch.

[0008]

5 In view of the foregoing situation, it is an object of the present invention to provide an electronic key system in which a user having a mobile unit can easily check a state of doors when doors of a vehicle is controlled by a communication between a mobile unit and a vehicle unit.

[0009]

10 [Means for solving the problem]

According to an electronic key system described in claim 1, the electronic key system comprising:

a mobile unit that receives an interrogational signal and sends back a predetermined code signal in response to the interrogational signal;

a controller that transmits the interrogational signal to the mobile unit, receives the code signal which was set back in response to the interrogational signal, checks a relation between the code signal and a memorized signal, and controls a state of a door of a vehicle based on a check result of the relation; and

an light emitting means that is disposed on the vehicle to indicate the state of the door.

[0010]

15 The electronic key system claimed in claim 1 includes a light emitting means that indicates according to the state of the door (locked, or unlocked). Accordingly, a user having the mobile unit can recognize the state of the door based on the indication of the light emitting means immediately.

[0011]

As claimed in claim 2, it is preferable that the light emitting means changes

an indication color between a first condition that the door is locked and a second condition that the door is unlocked. According to this structure, the state of door is clearly identified whether the door is locked or unlocked.

[0012]

The electronic key system claimed in claim 3, further comprising:

a detection means for detecting an opening operation of the door that is operated by a user having the mobile unit,

wherein the controller sets the door of the vehicle in an unlock-standby state when the code signal transmitted from the mobile unit is authenticated when the user having the mobile unit approaches the vehicle, and unlocks the door when the opening operation of the door is detected by the detection means in the unlock-standby state, and

the light emitting means starts to indicate the unlock-standby state of the door in a certain indication mode when the door becomes in the unlock-standby state, and the light emitting means changes the indication mode when the door is unlocked.

[0013]

5 The light emitting means can always emit light to indicate the door is locked when the doors are locked. However, in such a case, electric current consumption of the light emitting means is increased. Thus, as claimed in claim 3, it is preferable the light emitting means starts to emit the light from the unlock standby condition. In addition, when the light emitting means starts to emit the light at the
10 standby timing and when the user having the mobile unit approaches the vehicle, the light emitting means can impress the user so that the user is greeted by the light emitting means with starting to emit the light. As a result, in the standby condition, the light emitting means changes the illumination state when the door is unlocked, the user having the mobile unit can visually recognize that the door is changed from the
15 locked state in which unlock can be available (unlock standby state) to the unlock

state.

[0014]

As claimed in claim 4, it is preferable that the light emitting means is turned off when a certain time elapses or an engine of the vehicle is started, because when
5 the certain time elapses or the engine is started, the user can recognize the condition of the door.

[0015]

The electronic key system claimed in claim 5 the light emitting means starts to indicate that the door is unlocked when the door is closed after a user having the mobile unit gets out of the vehicle, and the light emitting means changes an indication mode to indicate that the door is locked in response to a lock of the door after the door is closed.

[0016]

10 Since the light emitting means starts to emit the light from the time when the user gets off the vehicle and closes the door, the necessary indication is performed to the user and the electric current consumption can be decreased. When the door lock switch provided around a steering wheel is operated and the door lock condition is satisfied, the control means locks the door. At the same time, the light emitting means emits the light to show the door is locked, the user can visually
15 recognize the door is locked.

[0017]

As claimed in claim 6, it is preferable that the light emitting means is turned off when a certain time elapses. The electric current consumption can be decreased.

[0018]

20 [Embodiment of the present invention]

The preferred embodiments of the present invention will be explained with reference to the accompanying drawings. FIG. 1 is a schematic view of the

electronic key system according to the present embodiment. As shown in FIG. 1, the electronic key system has a mobile unit (electronic key) 1 and an electronic key ECU 4 as a control unit. The electronic key ECU 4 checks an ID code of the mobile unit 1 by communication with the mobile unit 1. The electronic key ECU 4 controls a locked state of doors and a locked state of a steering of the vehicle based on the check result. The electronic key ECU 4 also controls permission and prohibition states of a start of an engine of the vehicle 10.

[0019]

As shown in FIG. 1, the vehicle 10 is provided with outside transmitters 2a -2d in the respective doors and the inside transmitter 2e in the vehicle compartment. The outside transmitters 2a -2d and the inside transmitter 2e transmit request signals (interrogatory signals) in response to a transmission signal from the electronic key ECU 4. Each of the outside transmitters 2a -2d transmits the request signal at a predetermined time interval when the vehicle is parked in a condition that the engine is stopped and the doors are locked. Each of ranges in which the request signals can reach is set to a predetermined distance, for example, on the order of 0.7 - 1.0 m. As a result, when the vehicle 10 is parked, outside detection areas are formed around the doors of the vehicle 10 in accordance with the ranges in such a manner as to immediately detect that a user having the mobile unit 1 approaches the vehicle 10.

[0020]

The inside transmitter 2e provides an inside detection area within the vehicle compartment when driver's side door is opened and closed, the engine is started, the doors are locked by the door lock switches. It is detected whether the mobile unit 1 exists within the vehicle compartment.

[0021]

The mobile unit 1 receives the request signal from the outside transmitters 2a -2d or the inside transmitter 2e, and is provided with a transmitting-receiving circuit

which transmits the predetermined ID code signal in response to the request signal. Thus, when the mobile unit 1 enters within the outside and inside detection areas, the mobile unit 1 immediately receives the request signal and transmits the ID code signal. The ID code signal includes a response code that indicates one of the outside transmitters 2a -2d, and the inside transmitter 2e.

[0022]

The receiver 3, which is disposed in the vehicle compartment of the vehicle 10, receives the ID code signal transmitted from the mobile unit 1. The receiver 3 outputs the ID code signal as a received signal to the electronic key ECU 4. The electronic key ECU 4 checks whether the ID code signal satisfies a predetermined relation. The electronic key ECU 4 checks whether the ID code signal corresponds to a registered ID code (authentication of the ID code).

[0023]

The door ECUs 5a - 5d lock the respective doors, unlock the respective doors, and set the respective doors in an unlock-standby state. The unlock-standby state is a condition that the doors can be unlocked when the outside door handles (door handle, hereinafter) are touched by the user having the mobile unit 1. The door ECUs 5a - 5d operate in response to an instruction signal from the electronic key ECU 4.

[0024]

When the electronic key ECU 4 determines that the received ID code corresponds to the registered ID code (ID code: OK), the electronic key ECU 4 determines a location of the user having the mobile unit 1 based on the response code. When the electronic key ECU 4 determines that the user having the mobile unit 1 is located within the outside detection area, the electronic key ECU 4 provides the instruction signal to one of the corresponding door ECUs 5a - 5d so that one of the corresponding doors becomes in the unlock-standby state. After that, one of the

door ECUs 5a - 5d sets the corresponding doors in the unlock-standby state in response to the instruction signal.

[0025]

The outside door handles 6a - 6d of the vehicle 10 have the respective touch sensors 6a1 - 6d1, which can detect whether the outside door handles 6a - 6d are touched by the user having the mobile unit 1 or not. The door lock switches 6a2 - 6d2 have respective push button switches. The doors are locked when corresponding door lock switches 6a2 - 6d2 are operated in a condition that the authentication of the ID code is completed. The outside door handles 6a - 6d function as the antennas of the outside transmitters 2a -2d, respectively.

[0026]

Each of the door handles 6a - 6d is provided with light emitting portions 6a4 - 6d4 having a red-LED and a green-LED. These light emitting portions 6a4 - 6d4 will be described later in detail.

[0027]

In a situation that the unlock-standby state is set by the door ECUs 5a - 5d in response to the instruction signal from the electronic key ECU 4, when one of the door ECUs 5a - 5d detects that one of the corresponding door handles 6a - 6d is touched by the user having the mobile unit 1, all doors are unlocked. That is, the doors are automatically unlocked when the user having the mobile unit 1 tries to open the doors. Instead of the touch sensors 6a1 - 6d1, another detection unit, which mechanically detect that the door handles 6a- 6d are pulled toward the user, may be used for detecting an operation for opening the doors. The unlock button can be disposed on the door handles, and the operation for opening the doors may be detected when the unlock button is operated.

[0028]

The vehicle electronic key system has a steering lock ECU 7 and an

engine ECU 8 to improve a security of the vehicle 10. The steering lock ECU 7 locks or unlocks a steering lock in response to the instruction signal from the electronic key ECU 4. The engine ECU 8 controls the permission and prohibition of the engine start in response to the instruction signal from the electronic key ECU 4.

[0029]

When the user having the mobile unit 1 rides into the vehicle 10 by opening and closing one of the doors, the electronic key ECU 4 communicates with the mobile unit 1 via the inside transmitter 2a and the receiver 3. The electronic key ECU 4 checks again the ID code by the communication. An engine switch 9 is provided in the vehicle 10. When the engine switch 9 is operated by the user, the steering lock ECU 7 asks to the electronic key ECU 4 whether the steering lock ECU 7 may unlock the steering lock. When the check result of the ID code is O.K., the electronic key ECU 4 replies to the steering lock ECU 7 so that the steering lock ECU 7 can unlock the steering lock. The steering lock ECU 7 unlocks the steering lock in response to the reply. At the same time, the electronic key ECU 4 outputs an instruction signal to the engine ECU 8 so that the engine ECU 8 cancels the prohibition state of the engine start. As a result, the user having the mobile unit 1 can perform from the riding on the vehicle by unlocking the doors to the starting the engine without holding the mobile unit 1 in hands.

[0030]

On the other hands, the electronic key ECU 4 can detect a certain condition. The certain condition includes that the vehicle 10 is parked, the user with the mobile unit 1 gets out of the vehicle 10 after the engine switch 9 is turned off, and at least one of the door lock switches 6a2 - 6d2 provided on door handles 6a - 6d is operated. When the electronic key ECU 4 detects such a condition, the electronic key ECU 4 outputs another instruction signal to the door ECUs 5a - 5d so as to lock the doors, respectively. At the same time, the electronic key ECU 4 outputs another

instruction signal to the engine ECU 8 so as to set the engine in the prohibition state of the engine start.

[0031]

Another device may be used instead of the door lock switches 6a2 - 6d2.

5 For example, touch sensors are used for detecting the door lock operation by the user.

[0032]

In such an electronic key system, when the user just has the mobile unit 1, the doors can be automatically locked and unlocked, and the security setting of the vehicle 10 can be automatically turned on and off.

10 [0033]

Next, the light emitting portions 6a4 - 6d4 disposed on the door handles 6a - 6d will be explained hereinafter. FIG. 2 shows a schematic front view of the door handle 6a. Because the door handles 6a - 6d have the same structure, the door handle 6a will be explained.

15 [0034]

As shown in FIG. 2, the door handle 6a has the door lock switch 6a2 and the light emitting portion 6a4. The touch sensor 611 and the antenna 613 are disposed inside the door handle 6a, and are not shown in FIG. 2. The light emitting portion 6a4 has a vertically oriented shape at one end of the door handle 6a so that
20 the light emitting portion 6a4 has approximately same length as a width of the door handle 6a. The light emitting portion 6a4 has the green LED that illuminates in green and the red LED that illuminates in red as described above. Since the light emitting portion 6a4 is disposed on the door handle 6a, the user can easily check the illumination state of the light emitting portion 6a4 when the user having the mobile unit
25 1 approaches the door 11 of the vehicle 10 and the user leaves the door 11.

[0035]

Next, a control of the illumination state of the light emitting portion 6a4 by

the door ECU 5a will be explained with FIGS. 3(a) and (b). FIG. 3(a) shows the control of the light emitting portion 6a4 in a case that the user having the mobile unit 1 gets on the vehicle 10, and FIG. 3 (b) shows the control of the light emitting portion 6a4 in a case that the user gets off the vehicle 10.

5 [0036]

As shown in FIG. 3 (a), the light emitting portion 6a4 is turned off when the vehicle 10 is parked and the doors are locked. The light emitting portion 6a4 may be turned on to show the locked state of the doors when the vehicle is parked and the doors are locked. However, in such a case, electric current consumption of the light
10 emitting portion 6a4 is increased. Accordingly, in this embodiment, the light emitting portion 6a4 is turned off when the doors are locked.

[0037]

In such a situation, when the user having the mobile unit 1 approaches the vehicle 10 and enters into the detection area of the outside transmitter 21, the
15 electronic key ECU 4 checks the ID code of the mobile unit 1 by the two-way communication with the mobile unit 1. As a result of the check, the door 11 is shifted from the locked state to the unlock-standby state when the check of the ID code is O.K. The unlock-standby state is the condition that the door 11 can be unlocked although the door 11 is locked. When the door 11 is shifted to the unlock-standby
20 state, the light emitting portion 6a4 starts to blink with red. The reason why the light emitting portion 6a4 blinks with red is because the door 11 is still locked in the unlock-standby state and the user can distinguish between the unlock-standby state and the locked state.

[0038]

25 Besides, because the light emitting portion 6a4 starts to blink when the user having the mobile unit 1 approaches the vehicle 10, the light emitting portion 6a4 can impress the user so that the user is greeted by the light emitting portion 6a4 with

starting to blink.

When the door ECU 5a detects that the door handle 6a is touched by the user having the mobile unit 1 by means of the touch sensor 6a1 in the unlock-standby state, the door ECU 5a unlocks the door 11 and changes the state of the light emitting portion 6a4. Since the lamp state of the light emitting portion 6a4 is changed when the door 11 is shifted from the unlock-standby state to the unlocked state, the user can easily recognize the unlocked state of the door 11. The illumination color of the light emitting portion 6a4 is changed from red to green when the door 11 is shifted from the locked state to the unlocked state. Accordingly, the user can clearly distinguish between the locked state and the unlocked state.

[0039]

The light emitting portion 6a4 is turned off when a predetermined time period elapses after the doors of the vehicle 10 is unlocked and the light emitting portion 6a4 starts to light in green or when the engine of the vehicle 10 is started. This is because it can be considered that it is unnecessary to light the light emitting portion 6a4 from then because the user having the mobile unit 1 already rides into the vehicle 10.

[0040]

As shown in FIG. 3(b), in a case that the user having the mobile unit 1 gets out of the vehicle 10, when the engine switch 9 is turned off and the door is closed after the door is once opened, the light emitting portion 6a4 starts to blink in green to indicate the unlock condition of the door. Since the light emitting portion 6a4 starts to blink when the door is closed after the user having the mobile unit 1 gets out of the vehicle 10, the light emitting portion 6a4 can indicate the door state to the user and the electric current consumption of the light emitting portion 6a4 can be decreased.

[0041]

In addition, when the user having the mobile unit 1 gets out of the vehicle

10, the electronic key ECU 4 checks the ID code of the mobile unit 1 by the communication with the mobile unit 1 via the outside transmitter 2a. When the check of the ID code is O.K. and the door lock switch 6a2 on the door handle 6a is operated by the user, the door is shifted from the unlocked state to the locked state. At the same time, the light emitting portion 6a4 changes the illumination state from the lighting in green to the lighting in red. As a result, since the light emitting portion 6a4 changes the illumination state when the door is shifted from the unlocked state to the locked state, the user having the mobile unit 1 can visually recognize that the door 11 is locked.

10 [0042]

The light emitting portion 6a4 is turned off when a predetermined time period elapses after the door 11 of the vehicle 10 is locked and the light emitting portion 6a4 starts to light in red.

[0043]

15 In the electronic key system of the embodiment, the light emitting portion 6a4 is controlled so that the light emitting portion 6a4 lights in accordance with the states of the respective doors (the locked state, the unlock-standby state, and the unlocked state). As a result, the user having the mobile unit 1 can immediately and visually recognize the states of the doors of the vehicle 10 based on the illumination state of the light emitting portion 6a4.

20

(Modification)

In the embodiment, when the user having the mobile unit 1 approaches the vehicle 10, the door 11 is shifted to the unlock-standby state. After that, when it is detected that the door handle is touched by the user, the doors are unlocked. However, the doors may be unlocked in a condition that the user having the mobile unit 1 just approaches the vehicle 10 and the check result of the ID code of the mobile unit 1 is O.K. In this case, the light emitting portion blinks in a condition which shows

25

the doors are locked until the ID code check is completed. When the ID code check is completed, the light emitting portion starts to blink in a condition which shows the doors are unlocked. Similarly, when the user gets out of the vehicle 10, the doors may be locked in a condition that the user having the mobile unit 1 just leaves the vehicle 10. In such a case, the light emitting portion 6a4 starts to blink so that the light emitting portion 6a4 indicates the unlocked state of the door when the door is closed after the user having the mobile unit 1 gets out of the vehicle 10. After that, when the user leaves the detection area of the outside transmitter, the illumination states is changed to indicate the locked states of the doors.

[0044]

In the embodiment, the light emitting portion 6a4 lights in response to three different states of the door, which include the locked state, the unlock-standby state, and the unlocked state. However, the light emitting portion may further change the illumination state in response to another door state. For example, vehicles having automatic slide door increase in recent years. In such a vehicle, the light emitting portion may light in a manner that the light emitting portion indicates that the slide door automatically opens and closes when the slide door is automatically opened or closed.

[0045]

In the embodiment, the light emitting portion indicates each state of the door. That is, the light emitting portion lights in red when the door is locked, blinks in red when the door 11 is in the unlock-standby state, and lights in green when the door is unlocked. However, an illumination mode, such as the color of the light and the way of the light, may be modified in various ways.

[0046]

In addition, in the embodiment, the light emitting portions are applied to the doors of the vehicle compartment. Another light emitting portion may be applied to a luggage door to emit the light in response to a state of the luggage door.

[Brief Description of The Drawings]

[FIG. 1]

FIG. 1 is a schematic block diagram of an electronic key system according to an embodiment of the present invention.

5 [FIG. 2]

FIG. 2 is an external view schematically showing a door handle.

[FIG. 3]

FIG. 3(a) is a chart for explaining a control of the light emitting portion when a user having a mobile unit rides into a vehicle, and FIG. 3(b) is a chart for explaining a control of the light emitting portion when the user gets out of the vehicle.

10

[Explanation of Numerals]

1mobile unit, 2a - 2d...outside transmitters, 2e...inside transmitter, 3...receiver, 4...electronic key ECU, 5a - 5d...door ECUs, 6a - 6d...door handles, 6a1 - 6d1...touch sensors, 6a2 - 6d2...door lock switches, 6a3 - 6d3
15 ...antennas, 6a4 - 6d4...light emitting portions, 7...steering lock ECU, 8... engine ECU, 9...engine switch

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[Name of the Document] Abstract of the Disclosure

[Abstract]

[Object]

5 It is an object of the present invention to provide an electronic key system in which a user having a mobile unit can easily check a state of doors when doors of a vehicle is controlled by a communication between a mobile unit and a vehicle unit.

[Means for solving problems]

10 Light emitting portions 6a4- 6d4 are disposed in each door handles of doors of a vehicle. The light emitting portions 6a4- 6d4 emit light in different modes in accordance with states of doors. Thereby, a user having the mobile unit 1 can easily recognize the states of the doors whether the door is unlocked or not.

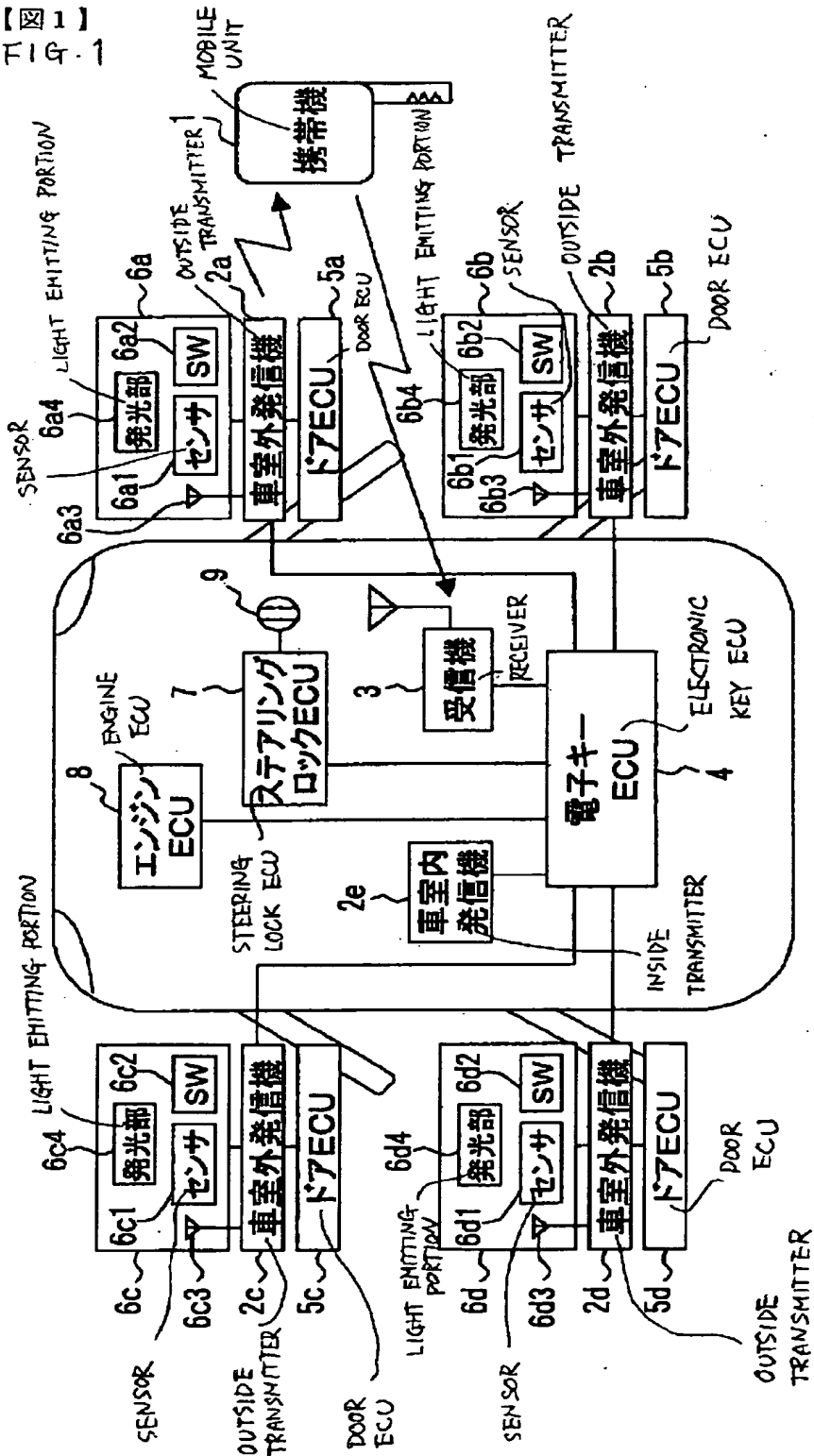
[Selected Figure] FIG. 3

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【書類名】 図面 DRAWINGS

【図1】
FIG. 1



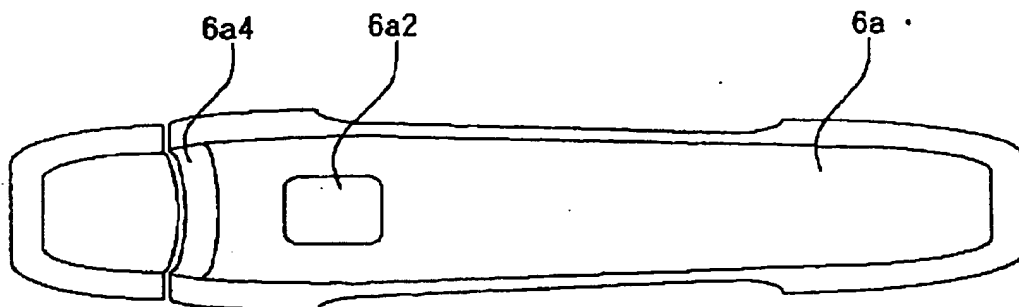
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【図2】

FIG. 2



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【図3】 FIG. 3

